# Part B: Automating the Loan Application Process

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| **Weight:** | 40% |
| **Due:** | 11:59pm Friday 20 October 2023 (end of Week 12) |

## Assignment Task

After due consideration of your process model and report, the key stakeholders of the bank would now like to move ahead and automate the loan application process and have decided to deploy the open-source BPMS *YAWL* to do so (https://yawlfoundation.github.io). Your team is required to transform the BPMN model you created for your previous report, after taking into account any relevant feedback, into the YAWL language and then fully automate the process, as well as certain nominated tasks within it. Specific requirements are listed in Sections A – D below.

The team will produce the following deliverables:

- a complete executable process model, defined in the YAWL language, and fully detailing the control-flow, data and resource perspectives
- a populated organisational model
- a set of data schema definitions, capturing the various documents and other information required and/or created during the process
- a set of services and code to automate certain tasks within the process
- a process log containing various runs of the process
- supporting documentation, addressing the needs of management, technical and user-level audiences.

**Please read this entire document very carefully, as detailed requirements are located throughout.**

# A. Data Perspective

This section details the various data structures required to capture the process data. Each must be defined within the process specification.

## Loan Application document

- **Applicant information**:
  - Identity information (title, last name, first name(s), date of birth)
  - Contact information (email, phone)
  - Current address (street name and number, city, post code)
  - Previous addresses in the last 5 years* [*may have more than one*] (format as above)
  - Financial information:
    - Employment details (current employer, monthly net salary)
    - Other income* [*may have more than one*] (type, monthly net income)
    - Monthly outgoings (total, not including existing loan and credit card repayments)
    - Bank accounts [*may have more than one*] (bank name, type of account and account number)
    - Current customer of this bank (yes/no)
- **Property information**:
  - Type of property (house, townhouse, apartment, etc)
  - Address (street name and number, city, post code)
  - Purchase price
- **Loan information** (amount, number of years, start date, interest rate)
- **Home insurance quote required** (yes/no)
- **Life insurance quote required** (yes/no)
- **New credit card quote required** (yes/no)
- **Administration information** (to be completed by the loan provider):
  - Loan Application identifier (auto-generated)
  - Submission date & time
  - Revision date & time* (if any)
  - Status (one of: “incomplete”, “complete”, “assessed”, “rejected”, “cancelled”, “approved”)
  - Comments on status* (e.g. used to explain the reasons for rejection)
  - Eligibility (yes/no - used by the loan officer to store whether the applicant is eligible for a loan)

  All fields of the loan application are mandatory except those shown with a *, which are optional.

  The data for all sections, except *Administration Information*, must be supplied by the applicant.

## Credit History report

- Loan Application identifier

- Loan applications made in the last five years [*may have more than one*] (loan type, amount, duration, interest rate, outstanding amount, monthly repayments)
- Credit card information [*may have more than one*] (provider, outstanding amount, credit limit, interest rate, monthly repayments)
- Public record information (optional, if any):
  - Court judgements (number outstanding)
  - Bankruptcy information [*may have more than one*] (date raised, current [yes/no]
- Credit assessment (a string with predefined values [best to worst]: AAA, AA, A, BBB, BB, B, unrated).

### Risk Assessment

- Loan Application identifier
- Risk weight (an integer from 0 to 100)
- Rule(s) applied in the risk weight calculation.

### Property Appraisal report

- Loan Application identifier
- Average value of three surrounding properties with similar characteristics
- Estimated market value of the loan application property
- Comments on property [optional] (to note any serious flaws the property may have).

### Repayment Agreement

- Loan Application identifier
- Repayment schedule:
  - Monthly repayment amount
  - Number of repayments.

### Home Insurance Quote

- Loan Application identifier
- Insurance sales representative name
- Home insurance total annual cost

### Life Insurance Quote

- Loan Application identifier
- Insurance sales representative name
- Life insurance total annual cost

### Credit Card Quote

- Loan Application identifier
- Finance officer's name
- Card limit ($)
- Regular interest rate
- Discounted interest rate for first 12 months

### Agreement summary

- Loan Application identifier
- Conditions agreed (yes/no indicating whether the applicant agreed with the loan conditions)
- Repayment agreed (yes/no indicating whether the applicant agreed with the repayment schedule)

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## B. Resource Perspective

As mentioned in the process description, employees, each performing one of five different roles, may be involved in the process:

- Financial Officer (belonging to the Finance Team)
- Property Valuer (belonging to the Finance Team)
- Insurance Sales Representative (belonging to the Sales Team)
- Loans Assistant (belonging to the Loans Team)
- Loans Assessor (belonging to the Loans Team)

Each of these roles are required to be created within the YAWL system, and a few sample employees created to populate **each** role. The employees shall be given fictional names (no more than 2 or 3 required for each role). No individual can be a member of more than one role. To assist marking, all individuals must be assigned the password ***orange***.

### Task distribution

- When a new application is received, it should be *allocated* to a loans officer using a *round robin* strategy. That loans officer is to be allocated all other user tasks of that process instance, other than those mentioned below.
- The final loan approval is to be done by a different loans officer to the above. That approval task should be *offered* to all loans officers not already involved in the case.
- The property appraisal should be allocated to a property valuer using a *shortest queue* strategy, and the task should be immediately *started* by the system.
- The credit report task should be *allocated* to a financial officer using a *random choice* strategy.
- The home insurance quote and life insurance quote tasks should be *allocated* to an insurance sales representative using a *Fastest to Start* strategy.
- The new credit card quote task should be *offered* to all financial officers.

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# C. Service Requirements

**NOTE: This is a group assignment. All members are required to contribute equally. Please ensure including a task responsibility matrix and annotate the codes with the name of the team member(s) who contributed it.**

**After assignment submission, a team member may be asked to justify choices made or to explain their code as part of the assignment assessment.**

## 1. Risk Assessment Service

A YAWL Custom Service is to be developed to calculate and return an overall risk assessment of the application. The service will receive as inputs the data necessary to assess the risk associated with the loan application. The service will return a single calculated risk weighting, to be represented as a numeric value between 0 and 100 (where 0 means minimum risk and 100 means maximum risk), and a list of the condition(s) that were satisfied during the calculation (i.e. only those conditions satisfied are to be listed). The rule for calculating the risk value is the **sum** of risk weightings (to a minimum of 0 and a maximum of 100) associated with each of the following conditions, wherever a condition evaluates to true:

| Condition | Risk Weighting |
|---|---|
| Deposit paid is less than or equal to 12% of the purchase price | 100 |
| Deposit paid is greater than 12% but less than 30% of the purchase price | A risk factor on a sliding scale from 100 for 12% deposit to 0 for 30% deposit |
| Currently bankrupt | 100 |
| Monthly loan repayment amount is greater than 40% of monthly available income* | 100 |
| Monthly loan repayment amount is greater than 20% but less than 40% of monthly available income* | A risk factor on a sliding scale from 100 for 40% to 0 for 20% deposit |
| Two or more previous addresses in the last five years | 10 per address (not counting the first pervious address) |
| Two outstanding court judgements | 10 |
| Three outstanding court judgements | 35 |
| Four or more outstanding court judgements | 50 |
| Estimated property value is less than the average surrounding property values | 10 for each $45,000 less, up to a maximum of 30 |
| Estimated property value is greater than the average surrounding property values | -10 for each $45,000 in excess, up to a maximum of -30 |
| Estimated property value is less than the purchase price of the property | 20 for each $30,000 less |

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| Estimated property value is greater than the purchase price of the property | -20 for each $45,000 in excess, up to a maximum of -50 |
| Credit assessment | AAA: -10; A: 5; BBB: 10; BB: 20; B: 30 |
| Is a current customer of this bank | -15 |

*Monthly available income is calculated as monthly income from all sources less the sum of monthly outgoings and existing loan and credit card repayments.

## 2. Archiving Service

A YAWL Custom Service is to be developed to archive each application after a final decision has been made and before the process instance completes. The following data should be input to the service and then archived to a database table for each completing case:

- Current date/time
- Loan application identifier
- Submission date/time
- Final status
- Comments on status

## 3. Application Identifier Generation

A YAWL codelet is to be developed to generate and return a new, unique loan application identifier. The identifier takes the format *99999/X/YY/NN*, where:

- *99999* is a five-digit numeric in the range 00001-99999. This numeric string will consist of the process instance identifier, padded to the left with zeros as necessary.
- *X* is an uppercase alphabetic character representing the month the application was received, where A=January, B=February, …, L=December
- *YY* is a two-digit numeric representing the year the application was received
- *NN* is two-digit numeric representing the absolute difference in years between the applicant's age at the time the application is received, and 65 years.

The codelet will receive as inputs the application data necessary to generate the identifier.

## 4. Repayment Calculation

A YAWL codelet is to be developed to calculate and return the monthly repayment amount, using the formula:

$$A = P\frac{r(1+r)^n}{(1+r)^n - 1}$$

where:

- ***A*** is the monthly repayment amount
- ***P*** is the amount of the loan requested
- ***r*** is the monthly interest rate [i.e. the annual interest rate divided by 12, expressed as a fraction, e.g. if the interest rate is 8%, *r* is 8/(100 * 12), or 8/1200]
- ***n*** is the total number of months in the repayment period

The codelet will receive as inputs the application data necessary to calculate the monthly repayment amount.

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## D. Automation Business Case

Senior management have also asked for a short report that presents a business case for automation. Specifically, for the home loan application process the report should:

a. Identify three BPM systems (BPMS) and rank them using the Analytic Hierarchy Process (AHP) method.
b. Estimate net benefits and costs for the top 2 ranked options.
c. Prepare a Net Present Value (NPV) Analysis (@18% interest rate) for the top 2 ranked options.
d. Write summary recommendations for senior management consideration.

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## Submission Requirements

**One** member of the team is to submit a **single** zip file via the *Assignment Submission* link on IFN653 Canvas page. The zip file will contain:

1. The fully populated process specification (*.yawl* file).
2. A backup of the resource model (*.ybkp* file).
3. A log file containing at least 10 complete executions of the process (*.xes* file).
4. The YAWL database (*.h2* file).
5. The source code files for each of the required services and codelets (*.java* files). All source code should follow standard java coding conventions and should be appropriately commented.
6. The compiled class files for each of the required services and codelets (*.class* files)
7. A reference manual, aimed at developers and analysts, which describes in detail how the process was developed and automated. The reference manual should include a diagram of the process model, the data schema definitions, and an organisational chart with the relevant roles and users displayed.
8. A user manual, aimed at end users, which explains how to use the system when working with the process. Include appropriate screenshots and descriptive text to aid a typical user through the process execution.
9. A report, aimed at senior management, that provides a business case and recommendations for the selection of a process automation suite for the organisation.
10. A declaration, signed by each group member, stating that they have viewed the **final** versions of all the required assignment submissions above and that **all** submitted items are ***entirely*** the original work of the group (see Appendix A for the declaration template).

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## Additional Information

- **LATE SUBMISSIONS**: According to QUT policies, submissions past the deadline will **NOT** be marked, and will thus attract a mark of 0/100. Therefore, you are strongly advised to submit your report, even if it is a draft only, by the due date.
- **ACADEMIC HONESTY**: Any action or practice on your part which would defeat the purposes of assessment is regarded as academic dishonesty. The penalties for academic dishonesty are provided in the Student Rules. For more information consult the Academic Integrity Kit available on the unit Canvas site, and the QUT Library resources for avoiding plagiarism.
- **GROUP FORMATION**: You may choose to form a group of 2 students*. Group members who work closely as a team and actively and equally contribute to the assignment work will receive the *same* group mark for their assignment. Group members who fail to make an active and equal contribution to the assignment work will be assessed *only* on the portion of the assignment work they produce.
- **GROUP DISPUTES**: Groups are entirely responsible for resolving their own group disputes. The teaching team will **NOT** become involved in these disputes.
- **GETTING FEEDBACK:** The teaching team will be available to answer *specific* questions about the assignment but **cannot pre-mark** assignments. The teaching team will **NOT** read report drafts and review detailed models prior to the submission of the assignment. Detailed feedback will be provided in written form, when the marker returns the marked assignment back to the students.

## Appendix A: Declaration Template

By submitting this assignment, I am/We are aware of the University rule that a student must not act in a manner which constitutes academic dishonesty as stated and explained in the QUT Manual of Policies and Procedures. I/We confirm that this work represents my individual/our team's effort, I/we have viewed the final version and does not contain plagiarised material.

| Full Name | Student No. | Signature |
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* you may also choose to complete the assignment individually if you wish.